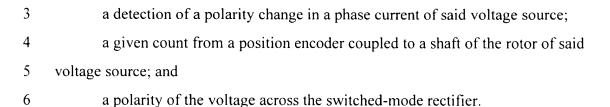
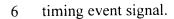
## CLAIMS

]	l.	An alternator system,	having an a	lternating current	(ac) vo	ltage source	having at

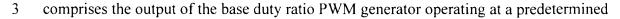
- 2 least one rotor, said ac voltage source having an output voltage controllable by a field
- 3 current thereof and an output, said alternator system comprising:
- a switched-mode rectifier (SMR) coupled to the ac voltage source and having an
- 5 output port coupled to an output of the alternator system; and
- a controller coupled to said switched-mode rectifier so as to provide a controlled
- 7 pulse sequence synchronized with an angular rotor position of the ac voltage source to
- 8 activate and deactivate said switched-mode rectifier.
- 1 2. The system of Claim 1 wherein the controller comprises a PWM generator having
- 2 a first input adapted to receive a total duty ratio signal synchronized with an angular rotor
- 3 position of the ac voltage source.
- 1 3. The system of Claim 2 wherein the controller further comprises:
- a bounded summation circuit having a first input, a second input, and an output coupled to the first input of the PWM generator;
- a base duty ratio generator coupled to the first input of the bounded summation circuit; and
- a timing duty ratio generator coupled to the second input of the bounded
- 7 summation circuit
- 1 4. The system of Claim 3 wherein the timing duty ratio generator comprises a first
- 2 input coupled to an output of a timing reference circuit adapted to receive a timing
- 3 reference event signal synchronized with the angular rotor position of the ac voltage
- 4 source.
- 1 5. The system of Claim 4 wherein the timing reference event signal is provided by
- 2 one of:



- 1 6. The system of Claim 1 wherein the controlled pulse sequence comprises a
- 2 plurality of intervals, the plurality of intervals repeating at a fundamental electrical
- 3 frequency of said voltage source, each such interval having an adjustable duration and
- 4 comprising a pulse width modulation (PWM) signal provided by a PWM generator
- 5 having an input coupled to a summation of a base duty ratio signal having a duty cycle
- 6 adjustable from zero to unity and a timing duty ratio signal synchronized with the angular
- 7 rotor position of the ac voltage source.
- The system of Claim 1 wherein a timing reference pulse of the controlled pulse sequence is triggered by an adjustable delay initiated by an event related to a fundamental electrical frequency of said voltage source.
- , ,
- The system of Claim 1 wherein the controlled pulse sequence comprises a
  plurality of intervals, the plurality of intervals repeating at a fundamental electrical
  frequency of said voltage source, each such interval having an adjustable duration and
  comprising the logical combination of a pulse width modulation (PWM) signal having a
  duty cycle adjustable from zero to unity and a timing reference pulse signal having a
  predetermined pulse duration interval less than a fundamental electrical period of said
- 7 voltage source.
- 1 9. The system of Claim 8 wherein an initial one of the plurality of intervals is
- 2 aligned with a timing reference event signal, the pulse signal duration of the initial
- 3 interval has a zero duration, such that the initial interval provides a pulse delay interval
- 4 having a predetermined duration, such that a first timing reference pulse signal of the
- 5 plurality of intervals occurs after the pulse delay interval following the reference signal



- 1 10. The system of Claim 9 wherein the timing reference event signal is provided by
- 2 one of:
- a detection of a polarity change in a phase current of said voltage source;
- a given count from a position encoder coupled to a shaft of the rotor of said
- 5 voltage source; and
- a polarity of the voltage across the switched-mode rectifier.
- 1 11. The system of Claim 1 wherein said controller comprises a microprocessor.
- 1 12. The system of Claim 1 wherein said controller is a programmable microprocessor
- 2 operable in response to stored program instructions; and said alternator system further
- 3 comprises a lookup table which can be interrogated by said programmable
- 4 microprocessor, to provide information in response to said event, for selectively
- 5 generating said controlled pulse sequence.
- 1 13. The system of Claim 1 wherein said controller comprises:
- 2 a pulse timing reference circuit;
- a timing reference pulse generator coupled to said pulse timing reference circuit;
- 4 and
- a logic element having a first input coupled to an output of said timing reference
- 6 pulse generator, and having an output coupled to said switched-mode rectifier.
- 1 14. The system of Claim 13 wherein said controller further comprises a base duty
- 2 ratio pulse width modulation (PWM) generator having an output coupled to a second
- 3 input of said logic element.
- 1 15. The system of Claim 14 wherein the pulse sequence further comprises a plurality
- 2 of adjustable time periods, wherein each of the plurality of adjustable time periods



- 4 duty ratio for the respective period.
- 1 16. The system of Claim 14 wherein said base duty ratio PWM generator has an input
- 2 coupled to a sensor which senses a parameter of a first one of said ac voltage source and
- an engine and in response thereto said sensor provides a signal representative of the
- 4 parameter to said base duty ratio PWM generator.
- 1 17. The system of Claim 16 wherein in response to signal information provided
- 2 thereto, said base duty ratio PWM generator provides a base duty ratio PWM signal to
- 3 said logic element which causes the switched-mode rectifier to operate with a particular
- 4 duty cycle selected to provide a controlled transformation of voltage and current between
- 5 terminals of the ac voltage source and output terminals of the alternator system and to
- 6 convert an ac voltage from the ac voltage source to a direct current (dc) voltage.
- 1 18. The system of Claim 16 wherein said sensor senses at least one of an ac voltage
- 2 source speed, an ac voltage source fundamental electrical frequency, and an ac voltage
- 3 source back emf.
- 1 19. The system of Claim 18 wherein said sensor comprises:
- 2 a sense winding electromagnetically coupled to the alternating current ac voltage
- 3 source; and
- 4 a back emf detection circuit.
- 1 20. The system of Claim 16 wherein said sensor is coupled to an engine and said
- 2 sensor senses at least one of an engine speed, and an engine frequency.
- 1 21. The system of Claim 1 further comprising a field controller comprising:
- an input port coupled to an output of the controller; and
- an output port coupled to an input port of a field current regulator to provide the

- 4 field current to said ac voltage source.
- 1 22. The system of Claim 22 wherein in response to a sensed output voltage being less
- 2 than a reference value the controller provides a first output signal to increase the field
- 3 current to said ac voltage source.
- 1 23. The system of Claim 21 further a sensor, said controller sensing an output voltage
- 2 level at the output of said alternator system, and comparing the sensed output voltage
- 3 level to a reference value, and providing control signals to said field controllerin response
- 4 to the comparison.
- 1 24. The system of Claim 22 wherein in response to the sensed output voltage being
- 2 less than the reference value the controller provides a first output signal to increase the
- 3 field current to said ac voltage source.
- 1 25. The system of Claim 1 further comprising a fault protection controller having an
- 2 input port coupled to an output of the alternator system and having an output port coupled
- 3 to an input of said controller.
- 1 26. The system of Claim 1 further comprising a thermal sensor disposed on the ac
- 2 voltage source and having an output port coupled to a thermal sensor input port of said
- 3 controller.
- 1 27. A method for controlling an alternator having an alternating current (ac) voltage
- 2 source, an output voltage controllable by a field current thereof and having a rectifying
- 3 circuit including a switched mode rectifier, the method comprising:
- 4 sensing an event synchronized with an angular rotor position of the ac voltage
- 5 source;
- 6 generating a controlled pulse sequence in response to sensing the event; and
- 7 providing said controlled pulse sequence to control the switched mode rectifier.

1	28.	The method of Claim 27 wherein generating a controlled pulse sequence				
2	comprises:					
3	providing a base duty ratio signal;					
4	providing a timing duty ratio signal;					
5		summing the base duty ratio signal and timing duty ratio signal to provide a total				
6	duty ratio signal; and					
7		generating a PWM signal having the total duty ratio.				
1	29.	The method of Claim 27 wherein said event is a timing mark derived from at least				
2	one of engine speed, engine frequency, an alternating current (ac) voltage source speed					
3	an ac voltage source frequency and an ac voltage source back emf.					
1	30.	A rectifier circuit for a multi-phase alternator having at least one phase winding				
2	output, the rectifier circuit comprising:					
3	at least one connection for receiving the respective at least one phase winding					
4	outpu	ıt;				
5		a positive output terminal;				
6		at least one first diode having a cathode connected to said positive output terminal				
7	and an anode connected to a respective one of said at least one phase winding outputs;					
8	at least one second diode having a cathode connected to the respective one of sai					
9	at least one of said phase winding outputs and an anode connected to a reference					
10	poten	tial; and				
11		at least one reactive device having a first port connected between a respective one				
12	of the at least one phase winding outputs and having a second port coupled to a second					
13	connection such that conduction times for said first and second diodes are modified					
14	resulting in increased output power.					
1	31.	The rectifier circuit of Claim 30 wherein said reactive device comprises a				
2	capacitor.					

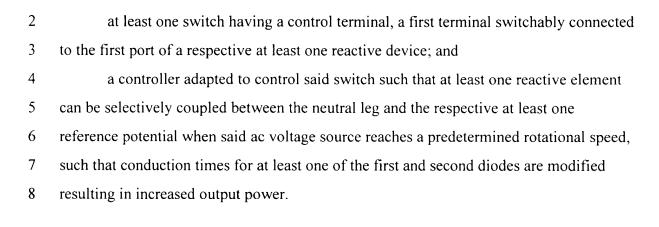
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2 the reference potential; 3 the positive output terminal; and 4 a respective phase winding output. 1 33. The rectifier circuit of Claim 30 further comprising more than one reactive 2 devices wherein the second ports of the more than one reactive devices are connected 3 together to form the second connection. 1 34. The rectifier circuit of Claim 30 wherein said reference potential comprises 2 ground. 1 1 35. The rectifier circuit of Claim 30 wherein the rectifier circuit further comprises a 2 negative output terminal and said reference potential comprises the negative output 3 terminal. 1 36. A rectifier circuit for a multi-phase alternator having an alternating current (ac) voltage source, a neutral leg and at least one phase winding output, the rectifier circuit 2 3 comprising: 4 a plurality of connections for receiving the at least one phase winding output; 5 a positive output terminal; 6 a first diode having a cathode connected to said positive output terminal and an 7 anode connected to the neutral leg; 8 a second diode having a cathode connected to neutral leg and an anode connected 9 to a negative output terminal; and 10 at least one reactive device having a second port coupled to the neutral leg and a 11 first port in selective electrical communication with a respective at least one reference 12 potential.

The rectifier circuit of Claim 30 wherein the second connection comprises one of:

37. The system of Claim 36 further comprising:



- 1 38. The rectifier circuit of Claim 36 wherein the respective at least one reference
- 2 potential comprises at least one of:
- a ground reference potential;
- 4 the negative output terminal; and
- 5 the positive output terminal.
- 1 39. The rectifier circuit of Claim 36 wherein the negative output terminal is a ground reference potential.
- 1 40. A rectifier circuit for a multi-phase alternator having a neutral leg and at least one 2 phase winding output, the rectifier circuit comprising:
- a plurality of connections for receiving the at least one phase winding output;
- a rectifier having a positive terminal and a negative terminal, coupled to said ac
- 5 voltage source;
- 6 a controller so as to provide a controlled pulse sequence;
- a first switch having a first terminal coupled to the neutral leg and having a second terminal coupled to a first reference potential; and
- wherein said first switch is coupled to said controller, such that the controller activates and deactivates said first switch.
- 1 41. The rectifier circuit of Claim 40 wherein the first switch comprises a metal oxide semiconductor field effect transistor (MOSFET).

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- 1 42. The rectifier circuit of Claim 40 wherein the respective first reference potential
  2 comprises at least one of:
  3 a ground reference potential;
  4 the negative output terminal; and
- 1 43. The rectifier circuit of Claim 40 further comprising a second switch coupled to the

neutral leg and having an output port coupled to a second reference potential such second

- 3 reference potential being different from the first reference potential; AND
- wherein said second switch is coupled to said controller, such that the controller activates and deactivates said first and second switches.
- 1 44. The rectifier circuit of Claim 43 wherein the first and second reference potentials comprise at least one of:
- 3 the negative output terminal; and

the positive output terminal.

- 4 the positive output terminal.
- 1 45. The rectifier circuit of Claim 43 wherein the first switch comprises a metal oxide
- 2 semiconductor field effect transistor (MOSFET) and the second switch comprises a
- 3 MOSFET.
- 1 46. The rectifier circuit of Claim 40 wherein the first switch comprises a diode.
- 1 47. The rectifier circuit of Claim 43 wherein the second switch comprises a diode.
- 1 48. A rectifier circuit for a multi-phase alternator having an alternating current (ac)
- 2 voltage source, a neutral leg and at least one phase winding output, the rectifier circuit
- 3 comprising:
- a plurality of connections for receiving the at least one phase winding output;
- 5 a rectifier having an output voltage port, at least one first diode and at least one

6	second diode, a cathode of the at least one first diode coupled to an anode of a respective						
7	at least one second diode;						
8	a circuit coupled to the output voltage port, said circuit comprising:						
9	at least one reactive device having a first port and a second port coupled t						
10	coupled to an anode of the respective at least one second diode;						
11	at least one switch having a control terminal, a first terminal coupled to th						
12	first port of a respective at least one reactive device and a second terminal coupled to a						
13	reference potential;						
14	a controller having an input terminal coupled to an output of a sensor, adapted to						
15	control said at least one switch such that a respective at least one reactive element can be						
16	selectively coupled between each of a respective phase winding output and the reference						
17	potential when said ac voltage source reaches a predetermined rotational speed, such that						
18	conduction times for the plurality of first and second diodes are modified resulting in						
19	increased output power.						
1	49. The rectifier circuit of Claim 48 wherein said reactive device comprises a						
2	capacitor.						
۷	Capacitor.						
1	50. The rectifier circuit of Claim 48 wherein said sensor senses at least one of:						
2	an ac voltage source speed;						
3	an ac voltage source fundamental electrical frequency;						
4	an ac voltage source back emf; and						
5	a rectifier output voltage.						
1	51. The rectifier circuit of Claim 48 wherein the reference potential comprises at least						
2	one of:						
3	the negative output terminal; and						
4	the positive output terminal.						